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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/527,607	11/17/2005	Giovanni Gilardi	AVAN/000835US	5231

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EXAMINER	
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ART UNIT	PAPER NUMBER
2883	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/527,607	GILARDI ET AL.
	Examiner	Art Unit
	James P. Hughes	2883

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 November 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *031105 042005*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because figures 1-6 contain numerous "hand drawn" aspects which are unclear. Applicant is advised to employ the services of a competent patent draftsperson outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pruneri et al. (2003/0002766) in view of Sugamata et al. (EP 0813 092). Pruneri et al. (2003/0002766), herein after referred to as Pruneri, teaches prior art a well-known asymmetric optical modulator comprising a Z-cut lithium niobate substrate (1) on which a Mach-Zehnder interferometer (MZI) is formed. The MZI comprises two generally parallel waveguides (e.g. 41 and 42) lying beneath a dielectric buffer layer (11) of silicon dioxide. Further, a first (8) and second (10) ground electrodes and a hot electrode (9) are disposed on the buffer layer (11). The first (8) and second (10) ground electrodes are spaced on either side of the hot electrode (9), with the first ground electrode (8) being proximate to at least one (e.g. 42) part of the respective waveguides. (See e.g., Paragraphs 14-18 and Figs. 1-4)

Wherein, as seen in Fig. 1, the device has an asymmetric electrode structure in which the hot electrode (9) and first ground electrode (8) each appear to have a width substantially less than that of the second ground electrode (10). Further in figure 1, the spacing between the first ground (8) and hot (9) electrodes appears to be different from the spacing between the second ground (10) and hot (9) electrodes. This difference is not labeled in the figures, but appears to be shown around the label "421" in figure 1.

However, these dimensions are not explicitly disclosed in Pruneri and the proportions of features in a drawing are not explicit evidence of actual proportions. See MPEP 2125. Additionally, Fig. 2 does not obviously confirm the electrode spacing inferred from Fig. 1.

Sugamata et al. (EP 0 813 092), herein after referred to as Sugamata teaches, as prior art, a well-known asymmetrical Mach-Zehnder interferometer similar to that of Pruneri. Sugamata teaches an optical modulator comprising a Z-cut lithium niobate substrate (1) on which a Mach-Zehnder interferometer (MZI) is formed. The MZI comprises two generally parallel waveguides (e.g. 2b and 2d) lying beneath a buffer layer (3) of dielectric material and first (5a) and second (5b) ground electrodes and a hot electrode (4) disposed on the buffer layer (3). The first (5a) and second (5b) ground electrodes are spaced on either side of the hot electrode (4), with the first ground electrode (5a) being proximate to at least one (e.g. 2b) part of the respective waveguides. (See e.g. Col 1, ll. 20-25; Col. 2, ll. 4-57; Figs 1-5)

Sugamata further teaches that the operating parameters of an asymmetric MZI may be adjusted to account for varying modulation efficiencies of the optical waveguides (e.g. 2b and 2d) and desired driving voltages. Sugamata teaches that this may be accomplished by adjusting the width of the first ground electrode (5a) or the spacing between the hot electrode (4) and the first ground electrode (5a). (See e.g. Col. 4, ll. 15-38)

Regarding claim 1, it would have been obvious to one of ordinary skill in the art at the time of the invention to alter the spacing between the first ground electrode (8) and hot electrode (9) in the invention of Pruneri such that this spacing may be different than the spacing between the second ground electrode (10) and the hot electrode (9) as Fig. 1 of Pruneri appears to indicate. One of ordinary skill in the art at the time of the invention would have been motivated to alter the spacing between the first ground electrode (8) and hot electrode (9) in the invention of Pruneri to adjust for varying waveguide modulation

efficiencies and/or desired driving voltages as taught by Sugamata (See e.g. Col. 4, ll. 15-38).

Regarding claims 2 and 3; Sugamata teaches that the width of the hot electrode (4) is approximate equal to the width of the waveguide (2a) beneath it; as recited in instant claim 2. Sugamata teaches that this will enhance an interaction between the lightwave propagation in the waveguide and the electric field produced by the electrodes, thereby reducing (i.e. optimizing) the driving voltage. (See e.g. Col. 2, ll. 35-55, Figs. 1b-3) Sugamata teaches that generally, the hot electrode (4) is about 10um wide, can be greater than 30um thick, and each ground electrode is spaced about 20-30 um from the ground electrodes (5a, 5b). (Col. 3, ll. 39-45) Sugamata further teaches that the width of the hot electrode (4), the spacing between the hot (4) and first ground (5a) electrodes, and the thicknesses of the electrodes may be adjusted to alter the effective index of refraction of the waveguides and the required driving voltages for a given frequency of light propagating in the waveguides. (See e.g. Col. 3, 15-45 and Col. 4, 26-38) However, neither Pruneri nor Sugamata neither explicitly teaches that the first ground electrode also has a width approximately equal to the width of the waveguide beneath it, nor that both electrodes have substantially equal width.

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a hot and first ground electrode with widths approximately equal to each other, or the widths of the respective waveguides beneath them, in the invention of Pruneri in view of Sugamata to optimize the driving voltages needed to achieve a desired response in each waveguide; as taught by Sugamata. One would have been motivated to optimize the effective index of refraction and/or driving voltage for the waveguides

because this would allow for an efficient operation of the device at different operating frequencies.

Regarding claims 4-7; neither Pruneri nor Sugamata explicitly teach the widths of the ground electrodes, the relative widths of the three electrodes, or which ground electrode (5a, 5b) is spaced further from the hot electrode (4). However, Sugamata teaches that in one MZI configuration, the hot electrode (4) is about 10um wide and the each ground electrode is spaced about 20-30 um from the ground electrodes (5a, 5b). (Col. 3, ll. 39-45)

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ various electrode geometries as recited in claims 4-7 and 10 in the invention of Pruneri in view of Sugamata because as addressed above regarding claims 2-3; Sugamata teaches that various electrode geometries may be employed to achieve a desired response in each waveguide. One would have been motivated to optimize the effective index of refraction and/or driving voltage for the waveguides because this would allow for an efficient operation of the device at different operating frequencies.

Regarding claim 8; neither Pruneri nor Sugamata explicitly teach that the spacing between the first ground and hot electrodes is between 10 and 30 um and the spacing between the second ground and hot electrodes is greater and between 20 and 80 um. However, Sugamata teaches that in one MZI configuration, the hot electrode (4) is about 10um wide and the each ground electrode is spaced about 20-30 um from the ground electrodes (5a, 5b). (Col. 3, ll. 39-45) It is possible for the geometries recited in instant claim 8 to fall within the geometry taught by Sugamata.

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ various electrode geometries as recited in claim 8 in the invention of Pruneri in view of Sugamata because as addressed above regarding claims 2-3; Sugamata teaches that various electrode geometries may be employed to achieve a desired response in each waveguide. One would have been motivated to optimize the effective index of refraction and/or driving voltage for the waveguides because this would allow for an efficient operation of the device at different operating frequencies.

Regarding claim 10; Sugamata teaches the well-known concept that the electrodes may comprise gold and may be greater than 30um thick. Sugamata teaches that the thickness of the electrodes is one of the variables involved with optimizing the MZI's performance. (See e.g. Col. 3, ll. 40-45 and the discussion regarding claims 2 and 3 above.)

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ electrodes between 15 and 50um in the invention of Pruneri in view of Sugamata because as addressed above regarding claims 2-3; Sugamata teaches that various electrode geometries may be employed to achieve a desired response in each waveguide. One would have been motivated to optimize the effective index of refraction and/or driving voltage for the waveguides because this would allow for an efficient operation of the device at different operating frequencies.

3. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pruneri et al. (2003/0002766) in view of Sugamata et al. (EP 0813 092) in further view of Seino et al. (5,404,412). Pruneri in view of Sugamata teaches an asymmetric optical

modulator comprising a Z-cut lithium niobate substrate (1) on which a Mach-Zehnder interferometer (MZI) is formed, as discussed above. However, Pruneri in view of Sugamata does not explicitly teach a silicon dioxide buffer layer between 0.4 and 1.5 um thick. Pruneri teaches the well-known concept that the buffer layer (11) may comprise silicon dioxide. (See e.g., paragraph 15)

Seino et al. (5,404,412), hereinafter referred to as "Seino", teaches an optical modulator comprising a Z-cut lithium niobate substrate (1) on which a Mach-Zehnder interferometer (MZI) is formed. Seino teaches two waveguide arms of the MZI in the substrate (1) each covered by a buffer layer and electrodes (4,5). Seino teaches the well known concept that the buffer layer in a MZI may comprise silicon dioxide with a thickness of 0.5 um. Seino also teaches that the silicon dioxide layer may vary between 0.25 – 2.5 um thick and that its thickness will affect the operation of the MZI. (See Col. 1, ll. 55 – Col. 2, ll. 20 and Figs. 1, 16, 18)

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a silicon dioxide buffer with a thickness between 0.4 and 1.5 um in the invention of Pruneri in view of Sugamata because Pruneri teaches that silicon dioxide may be employed as a buffer layer in a MZI and Seino teaches that silicon dioxide buffer layers in MZI modulators may vary between 0.25 – 2.5 um and the well known concept that the buffer thickness will affect the operation of the MZI. One would have been motivated to employ a specific buffer layer with a thickness between 0.4 – 1.5 um depending on desired properties of the MZI, to achieve an efficient device.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hallemeier et al. (6,198,855) teaches the well-known concept that that in MZI's the electrode thicknesses and widths are determined by the modulators design. See Col. 7, ll. 40-50.) Burns et al. (5,644,664 and 5,416,859) and Gopalakrishnan et al. (5,422,966) teach z-cut LiN03 MZI wherein the hot electrode and the first ground electrode each have a with substantially less than that of the second ground electrode. See e.g. 2B. Burns reads on, at least, instant claim 1. Dol et al. (2002/0141679, 6,584,240) teaches various electrode, buffer, and waveguide widths and thicknesses in a z-cut LiN03 MZI. (Fig. 1) Mitomi et al. (5,790,719) teaches various electrode, buffer, and waveguide widths and thicknesses in a z-cut LiN03 MZI. (Figs. 2-4)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James P. Hughes whose telephone number is 571-272-2474. The examiner can normally be reached on Monday - Friday 9am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font can be reached on 571-272-2415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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